74

SATURN S-IVB
STAGE WEIGHT AND BALANCE STATUS REPORT
MODEL NO. DSV-4B

(U)

15 DECEMBER 1963
DOUGLAS REPORT 44881

MISSILE & SPACE SYSTEMS DIVISION
DOUGLAS AIRCRAFT COMPANY, INC.
SANTA MONICA/CALIFORNIA

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15 DECEMBER 1963
DOUGLAS REPORT DAC-44881

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PREPARED FOR:
NATIONAL AERONAUTICS AND
SPACE ADMINISTRATION
UNDER CONTRACT NO. NAS7-101

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ABSTRACT

This contractually required report up-dates the weight and balance status of the Saturn S-IVB Stage from that shown in the previous report, SM-44880, dated 15 November 1963.

The weight tables and explanations of changes, which are presented in semi-detailed form (MSFC-STD-204A Second Generation Level of Detail) show that the S-V/S-IVB and S-IB/S-IVB dry weights have increased 732 and 607 pounds, respectively, as compared with the previous report.

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1.0 INTRODUCTION

The following pages constitute the seventh (15 December 1963) Weight and Balance Status Report for the Saturn S-IVB Stages reflecting those changes since the Weight and Balance Status Report, SM-44880 dated 15 November 1963.

The Saturn V/S-IVB dry weight change between the last and the current status reports is an increase of 732 pounds, consisting primarily of incorporating revised J-2 engine weights, weight of external insulation added to the forward dome of the LH_2 tank, revised ambient helium bottle weights and redesigned support structure weights for Telemetry and Measuring Equipment.

The Saturn IB/S-IVB dry weight change between the last and the current status reports is an increase of 607 pounds, consisting primarily of incorporating revised J-2 engine weights and the weight of external insulation added to the aft dome.

This report reflects only those items of the S-IVB Stage fabricated or installed per Douglas Aircraft Company drawings.

2.0 STATUS REPORT - SATURN V/S-IVB

The data given in this section reflects both the specification weight and the current weight of the Saturn S-IVB Stage for the Saturn V configuration, and are organized functionally (including alpha-numeric notation) in accordance with MSFC-STD-204A.

MODEL Saturn V/S-IVB
CONTRACT NUMBER NAS7-101
DATE 12-15-63 ISSUE No. 7
MISSION

		ORIGINAL Spec. WEIGHT AS OF MSFC Memo M-P&VE-ES -75-63 Dated 4-29-63	TOTAL MSFC RESPONSIBILITY & GFE CHANGES	REVISED Spec. WEIGHT	TOTAL CONTRACTOR RESPONSIBILITY CHANGES Over or Under	LAST [illegible] 880 DATED 11-15-63 ISSUE No. 6	CHANGE BETWEEN LAST & CURRENT STATUS REPORTS		CURRENT STATUS	CURRENT WEIGHT/ REVISED Spec. WEIGHT RATIO	CURRENT AVERAGE WEIGHT CLASS ACT 6.0 CAL 5.0 EST 4.0
							MSFC RESPONSIBILITY & GFE CHANGES	CONTRACTOR RESPONSIBILITY CHANGES			
Structure	W3.0	(12,762)	(+861)	(13,623)	(+699)	(14,200)	(+15)	(+107)	(14,322)	(1.051)	(4.6)
Propellant Container	3.3	9,454	+631	10,085	-75	9,929	---	+81	10,010	0.993	4.7
Forward of Tanks	3.6	1,165	---	1,165	+29	1,170	---	+24	1,194	1.025	5.0
Aft of Tanks	3.8	1,310	---	1,310	+685	2,015	---	-20	1,995	1.523	4.1
Thrust Structure	3.9	508	+215	723	+43	760	+15	-9	766	1.059	4.9
Fairings & Assoc. Structure	3.10	259	+15	274	-113	130	---	+31	161	0.588	4.0
Paint & Sealer	3.15	66	---	66	+19	85	---	---	85	1.288	4.0
Ablative Insul-Thermolag	3.18	0	---	---	+111	111	---	---	111	---	4.0
Propulsion Sys. & Accessories	W4.0	(5,636)	(+1,086)	(6,722)	(-92)	(6,400)	(+154)	(+76)	(6,630)	(0.986)	(4.5)
Engine & Accessories	4.1	3,343	+124	3,467	+100	3,443	+124	---	3,567	1.029	4.0
Purge System for Chilldown	4.6	61	+123	184	-34	150	---	---	150	0.815	4.0
Fuel System	4.7	1,362	+422	1,784	-174	1,546	---	+64	1,610	0.902	5.3
Oxidizer System	4.8	667	+387	1,054	-3	1,036	---	+15	1,051	0.997	4.9
Stage Control Syst. Hardware	4.10	203	+30	233	+19	225	+30	-3	252	1.082	4.2
Equipment & Instrumentation	W6.0	(3,502)	(+1,003)	(4,505)	(+1,292)	(5,417)	(---)	(+380)	(5,797)	(1.287)	(4.2)
Structure (Equip. & Instr.)	6.1	0	+54	54	+304	364	---	-6	358	6.630	4.3
Environmental Control Sys.	6.2	200	+104	304	-181	123	---	---	123	0.405	4.1
Control System Electronics	6.5	250	---	250	-211	39	---	---	39	0.156	4.0
Telemetry & Measuring Equip.	6.8	1,000	+955	1,955	+151	1,954	---	+152	2,106	1.077	4.0
Propellant Utilization Sys.	6.10	186	---	186	+26	212	---	---	212	1.140	4.1
Electrical System	6.11	492	---	492	+279	726	---	+45	771	1.567	4.0
Range Safety Equipment	6.12	90	---	90	-9	82	---	-1	81	0.900	4.0

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							MSFC RESPONSIBILITY & GFE CHANGES	CONTRACTOR RESPONSIBILITY CHANGES			
Pneumatic System	W6.15	43	---	43	+146	181	---	+8	189	4.395	5.2
Auxiliary Propulsion System	6.16	900	---	900	+813	1,546	---	+167	1,713	1.903	4.3
Separation System	6.17	200	-110	90	-10	65	---	+15	80	0.889	4.2
Systems for Total Vehicle	6.20	141	---	141	-16	125	---	---	125	0.887	4.0
Stage Dry Weight	Wad	(21,900)	(+2,950)	(24,850)	(+1,899)	(26,017)	(+169)	(+563)	(26,749)	(1.077)	(4.5)
Residual & Reserve Propellants and Service Items (2nd Burn)	W7.0	(2,978)	(+135)	(3,113)	(-70)	(3,043)	(---)	(---)	(3,043)		
Fuel Tank Pressurization & Residual Gases (GH_2 + He)	7.1	396	+62	458	+408	866	---	---	866		
Fuel - Mixture Ratio Shift	7.2	249	---	249	-124	125	---	---	125		
Fuel - Thrust Decay	7.3	25	---	25	---	25	---	---	25		
Fuel - Trapped	7.4	507	---	507	---	507	---	---	507		
Oxidizer Tank Pressurization & Residual Gases (He)	7.5	252	+193	445	+9	454	---	---	454		
Oxidizer-Mixture Ratio Shift	7.6	901	---	901	-451	450	---	---	450		
Oxidizer - Thrust Decay	7.7	75	---	75	---	75	---	---	75		
Oxidizer - Trapped	7.8	440	---	440	---	440	---	---	440		
Service Items	7.9	133	-120	13	+88	101	---	---	101		
Standard Propellant & Service Item Consumption (2nd Burn)	W8.0	(150,431)	(---)	(150,431)	(-958)	(149,473)	(---)	(---)	(149,473)		
Fuel	8.1	25,067	---	25,067	-159	24,908	---	---	24,908		
Oxidizer	8.2	125,334	---	125,334	-794	124,540	---	---	124,540		
Service Items (Roll Control)	8.4	30	---	30	-5	25	---	---	25		

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							MSFC RESPONSIBILITY & GFE CHANGES	CONTRACTOR RESPONSIBILITY CHANGES			
Other Weight Items (2nd Burn)	W9.0	(5,974)	(---)	(5,974)	(-780)	(5,194)	(---)	(---)	(5,194)		
Fuel - Thrust Buildup	9.1	165	---	165	---	165	---	---	165		
Oxidizer - Thrust Buildup	9.2	320	---	320	---	320	---	---	320		
Fuel - Vented	9.4	4,000	---	4,000	-600	3,400	---	---	340		
Service Items (Attitude Control Vent Cycle, Chilldown, Ullage)	9.6	1,489	---	1,489	-180	1,309	---	---	1,309		
Residual & Reserve Propellants and Service Items (1st Burn)	W7.0	(100)	(---)	(100)	(---)	(100)	(---)	(---)	(100)		
Fuel - Thrust Decay	7.3	25	---	25	---	25	---	---	25		
Oxidizer - Thrust Decay	7.7	75	---	75	---	75	---	---	75		
Standard Propellant & Service Item Consumption (1st Burn)	W8.0	(79,615)	(---)	(79,615)	(+951)	(80,566)	(---)	(---)	(80,566)		
Fuel	8.1	13,267	---	13,267	+158	13,425	---	---	13,425		
Oxidizer	8.2	66,332	---	66,332	+795	67,127	---	---	67,127		
Service Items (Roll Control)	8.4	16	---	16	-2	14	---	---	14		
Other Weight Items (1st Burn)	W9.0	(583)	(---)	(583)	(-34)	(549)	(---)	(---)	(549)		
Fuel - Thrust Buildup	9.1	165	---	165	---	165	---	---	165		
Oxidizer - Thrust Buildup	9.2	320	---	320	---	320	---	---	320		
Service Items (Ullage)	9.6	98	---	98	-34	64	---	---	64		
S-IVB Stage at Ground Ignition	Wag	(261,581)	(+3,085)	(264,666)	(+1,008)	(264,942)	(+169)	(+563)	(265,674)		

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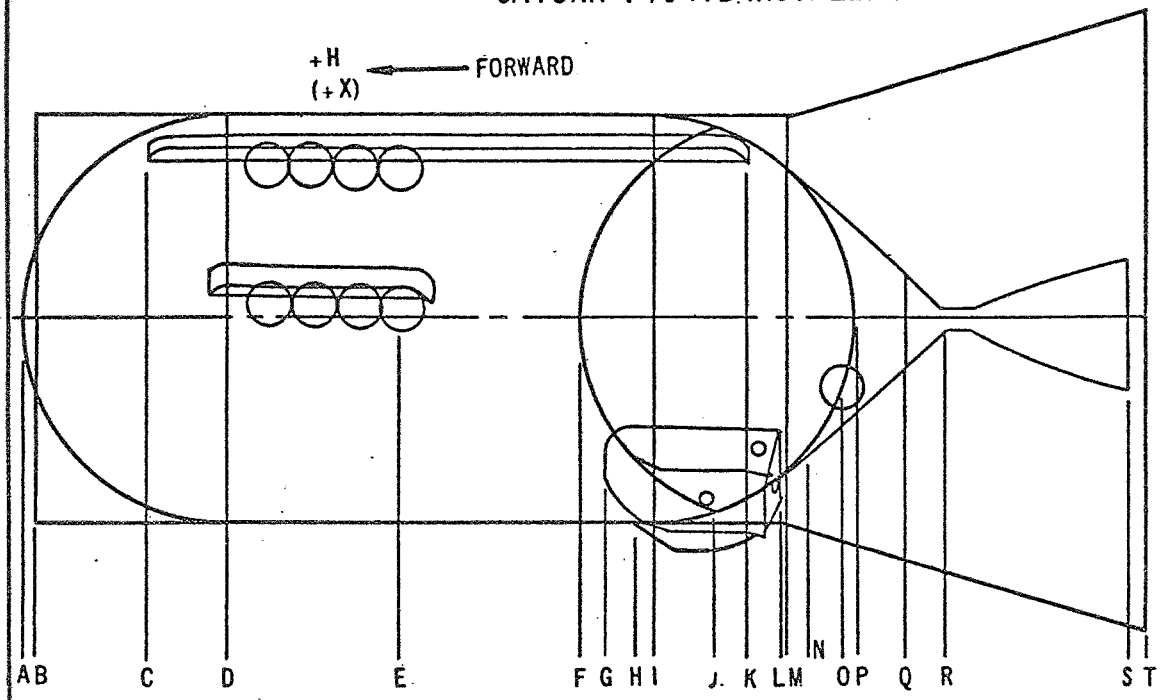
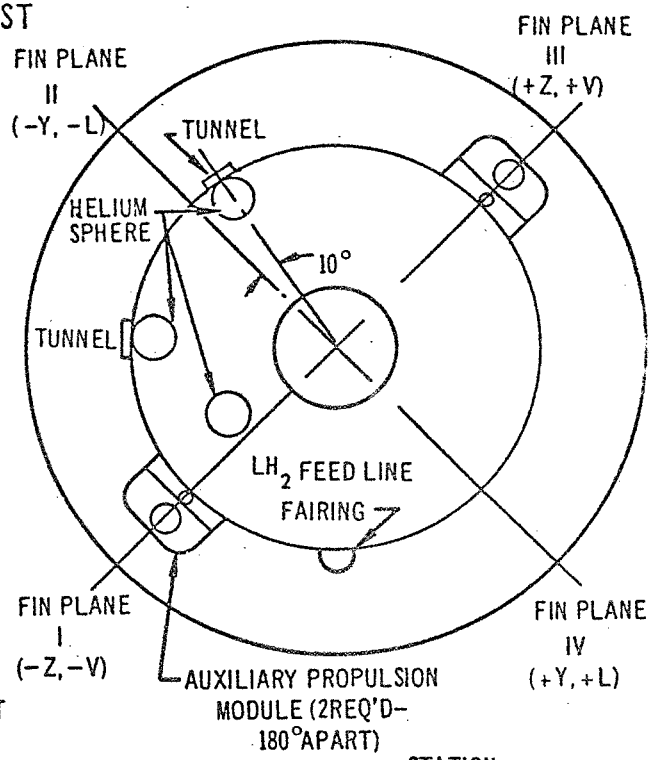
							MSFC RESPONSIBILITY & GFE CHANGES	CONTRACTOR RESPONSIBILITY CHANGES			
Structure	W3.0	(5,566)	(---)	(5,566)	(-82)	(5,452)	(---)	(+32)	(5,484)	(0.985)	(4.0)
Interstage	3.13	5,566	---	5,566	-162	5,372	---	+32	5,404	0.971	4.0
Paint & Sealers	3.15	0	---	---	+80	80	---	---	80	---	4.0
Equipment and Instrumentation	W6.0	(780)	(---)	(780)	(-101)	(682)	(---)	(-3)	(679)	(0.871)	(4.0)
Environmental Control Sys.	6.2	0	---	---	+29	32	---	-3	29	---	4.0
Separation System	6.17	780	---	780	-130	650	---	---	650	0.833	4.0
Dry SII/S-IVB Interstage	Wbd	(6,346)	(---)	(6,346)	(-183)	(6,134)	(---)	(+29)	(6,163)	(0.971)	(4.0)
Residual and Reserve Propellants and Service Items	W7.0	(1,080)	(---)	(1,080)	(-12)	(1,068)	(---)	(---)	(1,068)		
Service Items (Retro)	7.10	1,080	---	1,080	-12	1,068	---	---	1,068		
S-II/S-IVB Interstage at Ground Ignition	Wbg	(7,426)	(---)	(7,426)	(-195)	(7,202)	(---)	(+29)	(7,231)		

SATURN V /S-IVB INSTALLATION – STATION LIST





	INSTALLATION	STATION
A.	FWD. BULKHEAD (FWD END)	684.6
B.	FWD. SKIRT (FWD. END)	676.7
C.	TUNNEL (FWD. END)	607.7
D.	FWD. SKIRT (AFT. END)	554.7
	SIDEWALL (FWD. END)	554.7
	FWD. BULKHEAD (AFT END)	553.0
E.	COLD HELIUM BOTTLES 8 BOTTLES @ 26.9" ON CENTERS	454.0
F.	COMMON BULKHEAD (FWD. END)	335.2
G.	AUXILIARY PROPULSION MODULE (FWD. END)	315.2
H.	LH_2 FEED LINE FAIRING (FWD. END)	295.1
I.	SIDEWALL (AFT END)	286.1
	AFT BULKHEAD (FWD. END)	287.9

	INSTALLATION	STATION
I.	AFT SKIRT (FWD. END)	286.1
J.	COMMON BULKHEAD (AFT END)	244.9
K.	TUNNEL (AFT END)	224.1
L.	AUXILIARY PROPULSION MODULE (AFT END)	203.7
	LH_2 FEED LINE FAIRING (AFT END)	202.7
M.	AFT SKIRT (AFT END)	200.6
	INTERSTAGE (FWD END)	200.6
N.	TANGENT POINT THRUST STRUCTURE	186.7
O.	AMBIENT HELIUM SPHERES 10 SPHERES @ 22.5° ON CENTERS	166.8
P.	AFT BULKHEAD (AFT)	156.3
Q.	THRUST STRUCTURE (AFT END)	124.6
R.	GIMBAL STATION	100.0
S	ENGINE NOZZLE (AFT END)	-16.0
T.	INTERSTAGE (AFT END)	-26 9

Saturn V/S-IVB		Weight (Pounds)	Center of Gravity (DAC Station - Inches) X	Y	Z	Moment of Inertia (Kg-M-sec^2) Pitch	Roll
S-IVB Stage at Ground Ignition	Wag	265,674	285.3	-0.9	-0.3	100,700	9,830
Service Items (Ullage)	W9.6	-64					
S-IVB Stage at First Ignition	Wai	265,610	285.3	-0.9	-0.3	100,600	9,780
Fuel - Thrust Buildup	W9.1	-165					
Oxidizer - Thrust Buildup	9.2	-320					
S-IVB Stage at First Liftoff	Wal	265,125	285.1	-0.9	-0.3	100,000	9,780
Fuel	W8.1	-13,425					
Oxidizer	8.2	-67,127					
Service Items (Roll Control)	8.4	-14					
S-IVB Stage at First Cutoff	Wac	184,559	266.1	-1.3	-0.4	64,300	9,730
Fuel - Thrust Decay	W7.3	-25					
Oxidizer - Thrust Decay	7.7	-75					
S-IVB Stage at End of First Thrust Decay	Was	184,459	266.1	-1.3	-0.4	64,200	9,730
Fuel - Vented	W9.4	-3,400					
Service Items (Attitude Control, Vent Cycle, Ullage)	9.6	-1,309					
S-IVB Stage at Second Ignition	Wai	179,750	261.8	-1.3	-0.4	57,500	8,880
Fuel - Thrust Buildup	W9.1	-165					
Oxidizer - Thrust Buildup	9.2	-320					
S-IVB Stage at Second Liftoff	Wal	179,265	261.6	-1.3	-0.4	57,200	8,880
Fuel	W8.1	-24,908					
Oxidizer	8.2	-124,540					
Service Items (Roll Control)	8.4	-25					
S-IVB Stage at Second Cutoff	Wac	29,792	318.2	-6.2	-2.6	32,200	8,880
Fuel - Thrust Decay	W7.3	-25					
Oxidizer - Thrust Decay	7.7	-75					
S-IVB Stage at End of Second Thrust Decay	Was	29,692	318.6	-6.2	-2.6	32,100	8,880
S-IVB Stage Dry Weight	Wad	26,749	322.0	-7.5	-3.5	30,200	8,790

FLIGHT SEQUENCING

Saturn V/S-IVB		Weight (Pounds)	Center of Gravity (DAC Station - Inches) X	Y	Z	Moment of Inertia (Kg-M-Sec^2) Pitch	Roll
S-II/S-IVB Interstage at Ground Ignition	Wbg	7,231	66.3	-2.8	-0.9	3,770	5,960
Service Items (Retro)	W7.9	1,068					
S-II/S-IVB Interstage at End of Thrust Decay	Wbs	6,163	74.4	-3.3	-1.1	3,230	5,040

ITEM		CHANGE BETWEEN LAST & CURRENT STATUS REPORTS	REASONS FOR DIFFERENCES MSFC RESPONSIBILITY CHANGES Saturn (V/S-IVB)
Structure	W3.0	(+15)	
Thrust Structure	3.9	+15	Incorporates weight allowance for Scope Change 1040A, Vertical Engine Handling Kit, (+15 pounds).
Propulsion Sys. & Access.	W4.0	(+154)	
Engine & Accessories	4.1	+124	The electrical customer connect panel is now installed by DAC instead of Rocketdyne, (+13 pounds). The pneumatic customer connect panel installation is redesigned to reflect changes to the J-2 engine interface, (+36 pounds). The weight for the J-2 engine is revised to reflect current Rocketdyne information, (+75 pounds).
Stage Control Sys. Hard.	4.10	+30	Incorporates weight allowance for Scope Change 1051, Increased Pressure for Stage Hydraulic System, (+30 pounds).

ITEM		CHANGE BETWEEN LAST & CURRENT STATUS REPORTS	CONTRACTOR RESPONSIBILITY CHANGES (Saturn V/S-IVB) REASONS FOR DIFFERENCES
Structure	W3.0	(+107)	
Propellant Container	3.3	+81	The aft dome fittings are revised to reflect a redesign due to tooling tolerances, (+2 pounds). External insulation is added to the forward dome to reduce the heat flow into the LH_2 tank, (+83 pounds). The weight of external insulation, located on the aft bulkhead, is revised to reflect current design information, (-4 pounds).
Forward of Tanks	3.6	+24	The weight of the forward skirt has been revised to reflect miscellaneous changes from layouts to production drawings, (+10 pounds). The weight for the fuel vent line support structure is revised in anticipation of future design modifications, (+4 pounds). A weight estimate, previously omitted, for attaching the S-IVB stage to the Instrument Unit is now included, (+10 pounds).
Aft of Tanks	3.8	-20	The weight of the aft skirt is revised to reflect miscellaneous changes from estimates to production drawings, (+13 pounds). The weight estimate for the hydrogen feed and chilldown line cutout support structure is revised in anticipation of future design modifications, (+7 pounds). The supporting structure for the Auxiliary Propulsion Module is reallocated to the Auxiliary Propulsion System, W6.16, in accordance with the functional organization of MSFC-STD-204A, (-40 pounds).
Thrust Structure	3.9	-9	The thrust structure frames and stringers are revised to reflect changes due to a refined strength analysis and a relocation of the ambient helium bottle supports, (-9 pounds).
Fairings & Assoc. Struc.	3.10	+31	The weight for hydrogen feed and fill line fairings is revised in anticipation of future design modifications, (+16 pounds). The skin gage on the tunnels is increased because of external pressure criteria, (+15 pounds).

ITEM		CHANGE BETWEEN LAST & CURRENT STATUS REPORTS	REASONS FOR DIFFERENCES CONTRACTOR RESPONSIBILITY CHANGES (Saturn V/S-IVB)
Propulsion & Accessories	W4.0	(+76)	
Fuel System	4.7	+64	The weight of the vent system bellows is revised to reflect current vendor information, (+5 pounds). The weight of the seven ambient helium bottles is revised to reflect new weight data due to a change in vendors, (+56 pounds).
Oxidizer System	4.8	+15	The weight of the two ambient helium bottles is revised to reflect new weight data due to a change in vendors, (+16 pounds). The weight for the lox fill line is revised to reflect current design information, (-1 pound).
Stage Control Sys. Hardware	4.10	-3	The weight estimate for the hydraulic system is revised to reflect current design information, (+27 pounds). The incorporation of Scope Change 1051 transfers weight from contractor responsibility to MSFC responsibility changes, (-30 pounds).
Equipment & Instrumentation	W6.0	(+380)	
Structure (Equip. & Instr.)	6.1	-6	The support structure for mounting equipment and wiring is redesigned to meet current acoustic design criteria, (+45 pounds). The support structure for telemetry is reallocated to Telemetry & Measuring Equipment, W6.8, in accordance with the functional organization of MSFC-STD-204A, (-46 pounds). The weight for secondary equipment mounting structure is revised to reflect miscellaneous changes from layouts to production drawings, (-5 pounds).
Telemetry & Measuring Equip.	6.8	+152	The support structure for telemetry is reallocated from Structure (Equip. & Instr.), W6.1, in accordance with the functional organization of MSFC-STD-204A, (+46 pounds). The support structure for equipment mounting and wiring is redesigned to meet current acoustic design criteria, (+119 pounds).

ITEM		CHANGE BETWEEN LAST & CURRENT STATUS REPORTS	REASONS FOR DIFFERENCES CONTRACTOR RESPONSIBILITY CHANGES (Saturn V/S-IVB)
Telemetry & Measuring Equip.	6.8		The electrical power distribution system wiring is reallocated to Electrical System, W6.11, in accordance with the functional organization of MSFC-STD-204A, (-13 pounds).
Electrical System	6.11	+45	The weight of support structure for batteries is revised in anticipation of future design modification, (+16 pounds). The electrical system weight is revised to reflect current design information, (+16 pounds). The electrical power distribution system wiring is reallocated from Telemetry & Measuring Equip., W6.8, (+13 pounds).
Range Safety Equipment	6.12	-1	Miscellaneous weight changes, (-1 pound).
Pneumatic System	W6.15	+8	The weight for the ambient helium bottle is revised to reflect new weight data due to a change in vendors, (+8 pounds).
Auxiliary Propulsion Sys.	6.16	+167	The supporting structure for the Auxiliary Propulsion Module is reallocated from Aft of Tanks, W3.8, in accordance with the functional organization of MSFC-STD-204A, (+40 pounds). The weight for the ullage control and attitude control engines are increased by (+12 pounds) and (+36 pounds) respectively to reflect current vendor information. The weight for the fuel and oxidizer systems are revised to reflect current design information, (+61 pounds). The weight for the pressurization system is revised to reflect current acoustical design criteria, (+11 pounds) and changes from layouts to production drawings, (+7 pounds).
Separation System	6.17	+15	The weight for the separation system installation hardware is revised to reflect changes from estimates to layout and production drawing calculations, (+10 pounds). The weight of the control distribution panel supports is revised in anticipation of future design modifications, (+5 pounds).

ITEM		CHANGE BETWEEN LAST & CURRENT STATUS REPORTS	REASONS FOR DIFFERENCES CONTRACTOR RESPONSIBILITY CHANGES (Saturn V/S-IVB)
S-II/S-IVB Interstage			
Structure	W3.0	(+32)	
Interstage	3.13	+32	The weight for the retro-rocket support structure is revised to reflect current design information, (+32 pounds).
Equipment & Instrumentation	W6.0	(-3)	
Separation System	6.17	-3	The weight for the retro-rocket support structure is revised to reflect current design information, (-26 pounds). The retro-rocket fairing is redesigned due to higher loads, (+9 pounds) and a change in material from fiberglass to aluminum, (+14 pounds).

3.0 STATUS REPORT - SATURN IB/S-IVB

The data given in this section reflects both the specification weight and the current weight of the Saturn S-IVB Stage for the Saturn IB configuration, and are organized functionally (including alpha-numeric notation) in accordance with MSFC-STD-204A.

MODEL Saturn IB/S-IVB
CONTRACT NUMBER NAS7-101
DATE 12-15-63 ISSUE No. 7
MISSION

		ORIGINAL Spec. WEIGHT AS OF MSFC Memo M-P&VE-ES-74-63 Dated 4-29-63	TOTAL MSFC RESPONSIBILITY & GFE CHANGES	REVISED Spec. WEIGHT	TOTAL CONTRACTOR RESPONSIBILITY CHANGES Over or Under	LAST STATUS SM-44880 DATED 11-15-63 ISSUE No. 6	CHANGE BETWEEN LAST & CURRENT STATUS REPORTS		CURRENT STATUS	CURRENT WEIGHT/ REVISED Spec. WEIGHT RATIO	CURRENT AVERAGE WEIGHT CLASS ACT 6.0 CAL 5.0 EST 4.0
							MSFC RESPONSIBILITY & GFE CHANGES	CONTRACTOR RESPONSIBILITY CHANGES			
Structure	W3.0	(12,193)	(+861)	(13,054)	(+298)	(13,140)	(+15)	(+197)	(13,352)	(1.023)	(4.8)
Propellant Container	3.3	9,294	+631	9,925	+3	9,779	---	+149	9,928	1.000	4.7
Forward of Tanks	3.6	1,056	---	1,056	-27	1,014	---	+15	1,029	0.974	5.0
Aft of Tanks	3.8	1,056	---	1,056	+269	1,314	---	+11	1,325	1.255	5.0
Thrust Structure	3.9	508	+215	723	+43	760	+15	-9	766	1.059	4.9
Fairings & Assoc. Structure	3.10	213	+15	228	-67	130	---	+31	161	0.706	4.0
Paint & Sealer	3.15	66	---	66	+19	85	---	---	85	1.288	4.0
Ablative Insul-Thermolag	3.18	0	---	---	+58	58	---	---	58	---	4.0
Propulsion Sys. & Accessories	W4.0	(4,781)	(+536)	(5,317)	(-149)	(5,017)	(+154)	(-3)	(5,168)	(0.972)	(4.1)
Engine & Accessories	4.1	3,343	+124	3,467	+100	3,443	+124	---	3,567	1.029	4.0
Purge System for Chilldown	4.6	61	+123	184	-34	150	---	---	150	0.815	4.0
Fuel System	4.7	507	+10	517	-70	446	---	+1	447	0.865	4.0
Oxidizer System	4.8	667	+249	916	-164	753	---	-1	752	0.821	4.6
Stage Control Sys. Hardware	4.10	203	+30	233	+19	225	+30	-3	252	1.082	4.2
Equipment & Instrumentation	W6.0	(2,776)	(+1,048)	(3,824)	(+410)	(3,990)	(---)	(+244)	(4,234)	(1.107)	(4.2)
Structure (Equip. & Instr.)	6.1	0	+54	54	+232	319	---	-33	286	5.296	4.4
Environmental Control System	6.2	200	+104	304	-178	123	---	+3	126	0.414	4.1
Control System Electronics	6.5	250	---	250	-211	39	---	---	39	0.156	4.0
Telemetry & Measuring Equip.	6.8	975	+960	1,935	+149	1,932	---	+152	2,084	1.077	4.0
Propellant Utilization Sys.	6.10	186	---	186	+26	212	---	---	212	1.140	4.1
Electrical System	6.11	150	---	150	+228	345	---	+33	378	2.520	4.0
Range Safety Equipment	6.12	90	---	90	-8	82	---	---	82	0.911	4.0
Pneumatic System	6.15	43	---	43	+3	46	---	---	46	1.070	4.0

MODEL Saturn IB/S-IVB
CONTRACT NUMBER NAS7-101
DATE 12-15-63 ISSUE No. 7
MISSION

		ORIGINAL Spec. WEIGHT AS OF MSFC Memo M-P&VE-ES -74-63 Dated 4-29-63	TOTAL MSFC RESPONSIBILITY & GFE CHANGES	REVISED Spec. WEIGHT	TOTAL CONTRACTOR RESPONSIBILITY CHANGES Over or Under	LAST STATUS SM-44880 DATED 11-15-63 ISSUE No. 6	CHANGE BETWEEN LAST & CURRENT STATUS REPORTS		CURRENT STATUS	CURRENT WEIGHT/ REVISED Spec. WEIGHT RATIO	CURRENT AVERAGE WEIGHT CLASS ACT 6.0 CAL 5.0 EST 4.0
							MSFC RESPONSIBILITY & GFE CHANGES	CONTRACTOR RESPONSIBILITY CHANGES			
Auxiliary Propulsion System	W6.16	300	+50	350	+203	486	---	+67	553	1.580	4.4
Separation System	6.17	200	-120	80	---	65	---	+15	80	1.000	4.2
Ullage System	6.18	241	---	241	-18	216	---	+7	223	0.925	5.2
Systems for Total Vehicle	6.20	141	---	141	-16	125	---	---	125	0.887	4.0
Stage Dry Weight	Wad	(19,750)	(+2,445)	(22,195)	(+559)	(22,147)	(+169)	(+438)	(22,754)	(1.025)	(4.5)
Residual & Reserve Propellants and Service Items	W7.0	(2,912)	(+149)	(3,061)	(-570)	(2,491)	(---)	(---)	(2,491)		
Fuel Tank Pressurization & Residual Gases (GH_2 + He)	7.1	343	+85	428	---	428	---	---	428		
Fuel - Mixture Ratio Shift	7.2	249	---	249	-124	125	---	---	125		
Fuel - Thrust Decay	7.3	25	---	25	---	25	---	---	25		
Fuel - Trapped	7.4	507	---	507	---	507	---	---	507		
Oxidizer Tank Pressurization and Residual Gases (He)	7.5	252	+184	436	---	436	---	---	436		
Oxidizer-Mixture Ratio Shift	7.6	901	---	901	-451	450	---	---	450		
Oxidizer - Thrust Decay	7.7	75	---	75	---	75	---	---	75		
Oxidizer - Trapped	7.8	440	---	440	---	440	---	---	440		
Service Items	7.9	120	-120	---	+5	5	---	---	5		
Standard Propellant & Service Item Consumption	W8.0	(219,876)	(---)	(219,876)	(+10,163)	(230,039)	(---)	(---)	(230,039)		
Fuel	8.1	36,823	---	36,823	+1,510	38,333	---	---	38,333		
Oxidizer	8.2	183,013	---	183,013	+8,654	191,667	---	---	191,667		
Service Items (Roll Control)	8.4	40	---	40	-1	39	---	---	39		

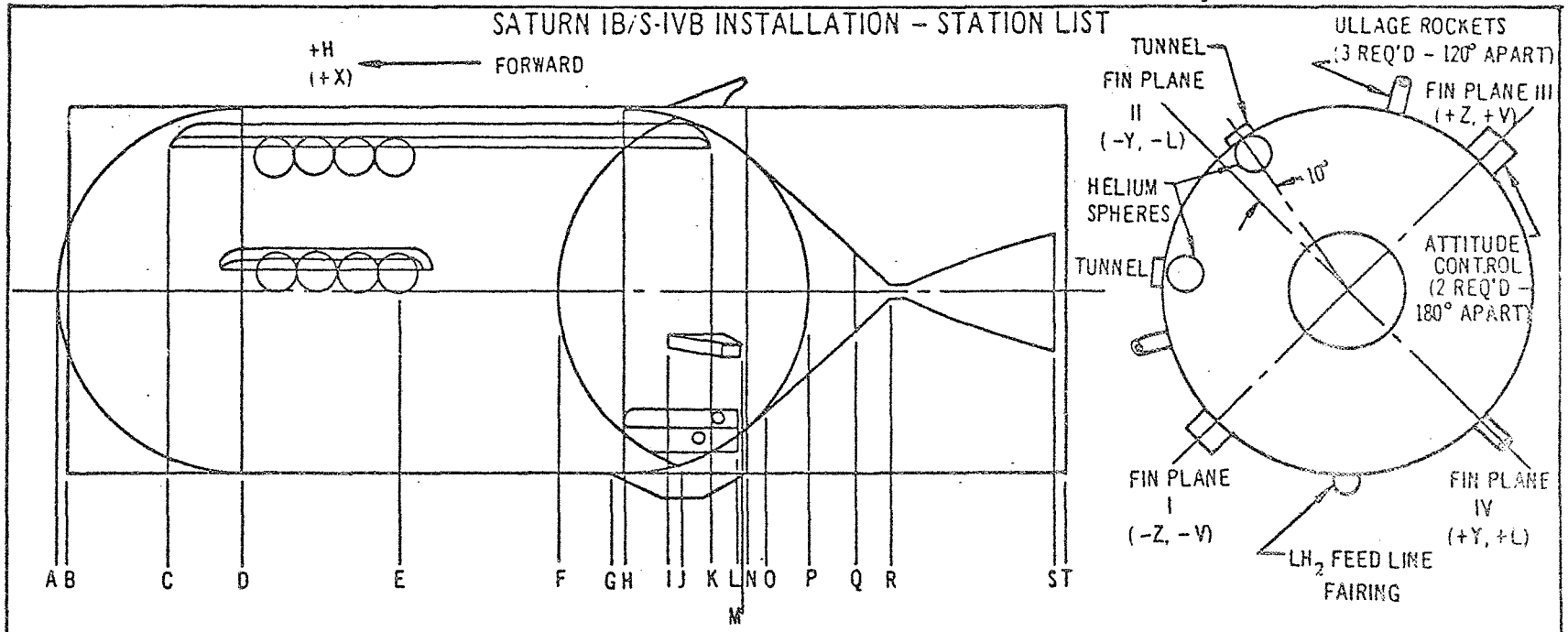
MODEL Saturn IB/S-IVB
CONTRACT NUMBER NAS7-101
DATE 12-15-63 ISSUE No. 7
MISSION

		ORIGINAL Spec. WEIGHT AS OF MSFC Memo M-P&VE-ES-74-63 dated 4-29-63	TOTAL MSFC RESPONSIBILITY & GFE CHANGES	REVISED Spec. WEIGHT	TOTAL CONTRACTOR RESPONSIBILITY CHANGES Over or Under	LAST STATUS SM-44880 DATED 11-15-63 ISSUE No. 6	CHANGE BETWEEN LAST & CURRENT STATUS REPORTS		CURRENT STATUS	CURRENT WEIGHT/ REVISED Spec. WEIGHT RATIO	CURRENT AVERAGE WEIGHT CLASS ACT 6.0 CAL 5.0 EST 4.0
							MSFC RESPONSIBILITY & GFE CHANGES	CONTRACTOR RESPONSIBILITY CHANGES			
Other Weight Items	W9.0	(667)	(---)	(667)	(+1)	(668)	(---)	(---)	(668)		
Fuel - Thrust Buildup	9.1	165	---	165	---	165	---	---	165		
Oxidizer - Thrust Buildup	9.2	320	---	320	---	320	---	---	320		
Service Items (Ullage)	9.6	182	---	182	+1	183	---	---	183		
S-IVB Stage at Ground Ignition	Wag	(243,205)	(+2,594)	(245,799)	(+10,153)	(255,345)	(+169)	(+438)	(255,952)		

MODEL Saturn 1B/S-IVB
CONTRACT NUMBER NAS7-101
DATE 12-15-63 ISSUE No. 7
MISSION

		ORIGINAL Spec. WEIGHT AS OF MSFC Memo M-P&VE-ES -74-63 Dated 4-29-63	TOTAL MSFC RESPONSIBILITY & GFE CHANGES	REVISED WEIGHT	TOTAL CONTRACTOR RESPONSIBILITY CHANGES Over or Under	LAST STATUS SM-44880 DATED 11-15-63 ISSUE No. 6	CHANGE BETWEEN LAST & CURRENT STATUS REPORTS		CURRENT STATUS	CURRENT WEIGHT/ REVISED Spec. WEIGHT RATIO	CURRENT AVERAGE WEIGHT CLASS ACT 6.0 CAL 5.0 EST 4.0
							MSFC RESPONSIBILITY & GFE CHANGES	CONTRACTOR RESPONSIBILITY CHANGES			
Structure	W3.0	(3,620)	(+10)	(3,630)	(-244)	(3,247)	(----)	(+139)	(3,386)	(0.933)	(4.9)
Interstage	3.13	3,620	+10	3,630	-315	3,176	----	+139	3,315	0.913	.0
Paint & Sealers	3.15	0	----	----	+43	43	----	----	43	----	4.0
Ablative Insul-Thermolag	3.18	0	----	----	+28	28	----	----	28	----	4.0
Equipment and Instrumentation	W6.0	(900)	(+16)	(916)	(+73)	(1,002)	(----)	(-13)	(989)	(1.080)	(4.0)
Separation System	6.17	900	+16	916	+73	1,002	----	-13	989	1.080	4.0
Dry S-IB/S-IVB Interstage	Wdb	(4,520)	(+26)	(4,546)	(-171)	(4,249)	(----)	(+126)	(4,375)	(0.962)	(4.7)
Residual and Reserve Propellants and Service Items	W7.0	(1,080)	(-20)	(1,060)	(-4)	(1,056)	(----)	(----)	(1,056)		
Service Items (Retro)	7.10	1,080	-20	1,060	-4	1,056	----	----	1,056		
S-IB/S-IVB Interstage at Ground Ignition	Wbg	(5,600)	(+6)	(5,606)	(-175)	(5,305)	(----)	(+126)	(5,431)		

SATURN IB/S-IVB INSTALLATION – STATION LIST



INSTALLATION	STATION
A. FWD. BULKHEAD (FWD. END)	684.6
B. FWD SKIRT (FWD. END)	676.7
C. TUNNEL (FWD. END)	607.7
D. FWD. SKIRT (AFT END)	554.7
FWD. BULKHEAD (AFT END)	553.0
E. COLD HELIUM BOTTLES 8 BOTTLES @ 26.9" ON CENTERS	454.0
F. COMMON BULKHEAD (FWD. END)	335.2
G. LH_2 FEED LINE FAIRING (FWD. END)	295.1
H. AFT SKIRT (FWD END)	286.1
ATTITUDE CONTROL MODULE (FWD. END)	285.5
AFT BULKHEAD (FWD. END)	287.9

INSTALLATION	STATION
I. ULLAGE ROCKET FAIRING (FWD. END)	255.6
J. COMMON BULKHEAD (AFT END)	244.9
K. TUNNEL (AFT END)	224.1
L. ATTITUDE CONTROL MODULE (AFT END)	205.1
M. ULLAGE ROCKET FAIRING (AFT END)	204.6
N. LH_2 FEED LINE FAIRING (AFT END)	202.7
AFT SKIRT (AFT END)	200.6
INTERSTAGE (FWD. END)	200.6
O. TANGENT POINT THRUST STRUCTURE	186.7
P. AFT BULKHEAD (AFT END)	156.3
Q. THRUST STRUCTURE (AFT END)	124.6
R. GIMBAL STATION	100.0
S ENGINE NOZZLE (AFT END)	-16.0
T. INTERSTAGE (AFT END)	-23.9

FLIGHT SEQUENCING

Saturn IB/S-IVB		Weight (Pounds)	Center of Gravity (DAC Station - Inches) X	Y	Z	Moment of Inertia (K_g-M-sec^2) Pitch	Roll
S-IVB Stage at Ground Ignition	Wag	255,952	280.7	-0.6	-0.2	80,000	7,720
Service Items (Ullage)	9.6	-183					
S-IVB Stage at Ignition	Wai	255,769	280.7	-0.6	-0.2	79,900	7,670
Fuel - Thrust Buildup	W9.1	-165					
Oxidizer - Thrust Buildup	9.2	-320					
S-IVB Stage at Liftoff	Wal	255,284	280.5	-0.6	-0.2	79,400	7,670
Ullage System	W6.18	-223					
Fuel	W8.1	-38,333					
Oxidizer	8.2	-191,667					
Service Items (Roll Control)	8.4	-39					
S-IVB Stage at Cutoff	Wac	25,022	320.7	-4.1	-2.3	27,000	7,590
Fuel - Thrust Decay	W7.3	-25					
Oxidizer - Thrust Decay	7.7	-75					
S-IVB Stage at End of Thrust Decay	Was	24,922	321.2	-4.1	-2.3	26,900	7,590
S-IVB Stage Dry Weight	Wad	22,754	331.2	-4.3	-2.6	25,300	7,470

FLIGHT SEQUENCING

Saturn IB/S-IVB		Weight (Pounds)	Center of Gravity (DAC Station - Inches) X	Y	Z	Moment of Inertia ($Kg-M-sec^2$) Pitch	Roll
S-IB/S-IVB Interstage at Ground Ignition	Wbg	5,431	62.7	-1.0	-0.3	1,557	2,705
Service Items (Retro)	W7.9	1,056					
S-IB/S-IVB Interstage at End of Thrust Decay	Wbs	4,375	66.5	-1.3	-0.4	1,254	2,179

ITEM		CHANGE BETWEEN LAST & CURRENT STATUS REPORTS	MSFC RESPONSIBILITY CHANGES REASONS FOR DIFFERENCES — Saturn IB/S-IVB
Structure	W3.0	(+15)	
Thrust Structure	3.9	+15	Incorporates weight allowance for Scope Change 1040A, Vertical Engine Handling Kit,(+15 pounds).
Propulsion Sys. & Accessories	W4.0	(+154)	
Engine & Accessories	4.1	+124	The electrical customer connect panel is now installed by DAC instead of Rocketdyne,(+13 pounds). The pneumatic customer connect panel installation is redesigned to reflect changes to the J-2 engine interface, (+36 pounds). The weight for the J-2 engine is revised to reflect current Rocketdyne information, (+75 pounds).
Stage Control Sys. Hardware	4.10	+30	Incorporates weight allowance for Scope Change 1051, Increased Pressure for Stage Hydraulic System, (+30 pounds).

ITEM		CHANGE BETWEEN LAST & CURRENT STATUS REPORTS	CONTRACTOR RESPONSIBILITY CHANGES (Saturn IB/S-IVB) REASONS FOR DIFFERENCES
Structure	W3.0	(+197)	
Propellant Container	3.3	+149	External insulation is added to the aft dome to reduce heat flow into the hydrogen and to lower the temperature gradient of the ground thermal conditioning system, (+147 pounds). The aft dome fittings are revised to reflect a redesign due to tooling tolerances, (+2 pounds).
Forward of Tanks	3.6	+15	A weight allowance, previously omitted, for attaching the S-IVB Stage to the Instrument Unit is now included, (+10 pounds). Miscellaneous weight changes, (+5 pounds).
Aft of Tanks	3.8	+11	The weight estimate for the fuel feed and chilldown lines cutout support structure is revised in anticipation of future design modifications, (+7 pounds). Miscellaneous weight changes, (+4 pounds).
Thrust Structure	3.9	-9	The thrust structure frames and stringers are revised to reflect changes due to a refined strength analysis and a relocation of the ambient helium bottle supports, (-9 pounds).
Fairings & Assoc. Structure	3.10	+31	The weight for hydrogen feed and fill line fairings is revised in anticipation of future design modifications, (+16 pounds). The skin gage on the tunnel is increased because of external pressure criteria, (+15 pounds).
Propulsion Sys. & Accessories	W4.0	(-3)	
Fuel System	4.7	+1	Miscellaneous weight changes, (+1 pound).
Oxidizer System	4.8	-1	Miscellaneous weight changes, (-1 pound).
Stage Control Sys. Hardware	4.10	-3	The weight estimate for the hydraulic system is revised to reflect current design information, (+27 pounds). The incorporation of Scope Change 1051, Increased Pressure for Stage Hydraulic System, transfers weight from contractor responsibility to MSFC responsibility changes, (-30 pounds).

ITEM	CHANGE BETWEEN LAST & CURRENT STATUS REPORTS	REASONS FOR DIFFERENCES CONTRACTOR RESPONSIBILITY CHANGES (Saturn IB/S-IVB)
Equipment & Instrumentation W6.0	(+244)	
Structure (Equip. & Instr.) 6.1	-33	The support structure for the mounting of equipment and wiring is redesigned to meet current acoustic design criteria, (+23 pounds). The support structure for telemetry, (-46 pounds) and ullage rockets, (-10 pounds) is reallocated to Telemetry & Measuring Equip., W6.8, and Ullage System, W6.18, respectively, in accordance with the functional organization of MSFC-STD-204A.
Environmental Control System 6.2	+3	The weight of the aft compartment air conditioning system is revised to reflect miscellaneous changes due to current design information, (+3 pounds).
Telemetry & Measuring Equip, 6.8	+152	The support structure for telemetry is reallocated from Structure (Equip. & Instr.), W6.1, in accordance with the functional organization of MSFC-STD-204A, (+46 pounds). The support structure for mounting equipment and wiring is redesigned to meet current acoustic design criteria, (+119 pounds). The electrical power distribution wiring is reallocated to Electrical System, W6.11, in accordance with the functional organization of MSFC-STD-204A, (-13 pounds).
Electrical System 6.11	+33	The electrical power distribution system wiring is reallocated from Telemetry & Measuring Equip., W6.8, in accordance with the functional organization of MSFC-STD-204A, (+13 pounds). The electrical system weight is revised to reflect current design information, (+20 pounds).
Auxiliary Propulsion Sys. 6.16	+67	The weight estimate for the auxiliary propulsion system attach structure is revised to reflect current design information, (+18 pounds). The weight for the attitude control engines is revised to reflect current vendor information, (+36 pounds). The weight for the Auxiliary Propulsion Fairing is increased to reflect the addition of two access doors and their associated structure to each module, (+13 pounds).

ITEM		CHANGE BETWEEN LAST & CURRENT STATUS REPORTS	CONTRACTOR RESPONSIBILITY CHANGES (Saturn IB/S-IVB) REASONS FOR DIFFERENCES
Separation System	6.17	+15	The weight for the separation system installation hardware is revised to reflect changes from estimates to layout and production drawing calculations, (+10 pounds). The weight estimate for control distribution panel supports is revised in anticipation of future design modifications, (+5 pounds).
Ullage System	6.18	+7	The weight for the mounting hardware is revised to reflect a redesign to meet current acoustic design criteria, (+18 pounds). The Ullage System supporting structure is reallocated from Structure (Equip. & Instr.), W6.1, in accordance with the functional organization of MSFC-STD-204A, (+10 pounds). The weight for the Ullage System is revised to reflect changes from estimates to production drawings, (-21 pounds).
S-IB/S-IVB Interstage			
Structure		(+139)	
Interstage		+139	The skin weight is revised to reflect a calculation error, (-14 pounds). The weight for frames and stringers is revised to reflect current design analysis, (+164 pounds). The weight for heat protection shield is revised to reflect current design information, (-10 pounds). Miscellaneous weight change, (-1 pound).
Equipment & Instrumentation	W6.0	(-13)	
Separation System	6.17	-13	The weight for the separation system is revised to reflect changes from estimates to production drawings, (-13 pounds).

APPENDIX I

SCOPE CHANGES INCORPORATED IN THE SATURN S-IVB WEIGHT AND BALANCE STATUS REPORT

SCOPE CHANGES INCORPORATED IN THE SATURN S-IVB

WEIGHT AND BALANCE STATUS REPORT

Scope Change	Title	Effectivity Saturn V	Effectivity Saturn IB
1001 B	Telemetry System	X	X
*1011 A	S-II Retro Rockets	X	
1016 B	Deletion of S-IVB Retro Rockets	X	X
1024	Turbo Pump Warm Helium Purge	X	X
1027 A	Recirculation Chilldown and Prevalve Installation	X	X
*1033 A	Leak Detection	X	X
1040 A	Vertical Engine Handling Kit	X	X
1051	Increased Pressure for Stage Hydraulic System	X	X
1060	Extension of Aft Interstage	X	
*1070	Redesign of Lox Tank Slosh Baffle	X	X
*1071	Redesign of Thrust Structure	X	X
1075 B	Propellant Tanks Redesign	X	X
1096	Deletion of Heat Barriers	X	X
1097	APS Propellant Capacity Redesign		X
*1102	S-IB Retro Rockets		X

*Proposed